

Week 8 Worksheet

Chem 11200-2: Section 33

March 1, 2022

Problem 1: Correctly draw and fill in the orbital diagrams for the following atoms or ions:

a) S atom

b) Cu atom

c) Fe^{2+} ion

Problem 2: Write the noble gas ground state electron configuration for each of the following atoms or ions:

a) B

d) Bi

b) Br^-

e) Bk

c) Ba^{2+}

f) Bh

In the electron configurations in the problem above, circle the valence e^- .

Lets revisit some concepts from last quarter, but now equipped with the knowledge of the electronic structure of atoms!

Problem 3: In the chemical reaction of first and second groups metals with water, H_2O takes e^- from the metals to form H_2 , metal cations, and OH^- . The more reactive the metal, the more readily it loses e^- ; therefore, the more easily H_2O takes e^- from the metal.

- Compare the reactivities of Na and Mg. Which should be more reactive with water? Explain why, using the concepts of shielding, effective nuclear charge, and atomic size (Don't just state trends!).
- Compare the reactivities of Li and K. Which should be more reactive with water? Explain why using concepts of shielding and atomic size.
- If we dropped a piece of Cs into a beaker of water, how reactive would you expect it to be? Explain.

Problem 4: In each of the following pairs, explain which should have the largest radius.

a) Sn vs Sb

b) S vs S^{2-}

c) Sr vs Sr^{2+}

Problem 5: When non-metals react, they do so by gaining e^- , and the ease with which an atom gains an e^- is called electron affinity (EA). The most reactive non-metal is F.

- a) By comparing F to both C and Br, explain why F is the most reactive non-metal, using the concepts of shielding, effective nuclear charge, and atomic size (Don't just state trends!)
- b) Since non-metal reactivity and EA both trend toward the top right corner of the Periodic Table, explain why He is not reactive as a non-metal and has zero electron affinity.

The following problems are written by Professor Mcleod or Head TA Miah Turke. They may mimic homework problems closely, but will be highly beneficial for the midterms and final.

Problem 6: On your last homework, you were asked to draw the energy level diagram of a H atom. For this problem, draw the energy level diagram for a N atom including approximate energies of each energy level. What are the differences between the H and N energy level diagrams? Only include $n = 1$ and $n = 2$.

Problem 7: Draw the bonding overlap, if any, between the following sets of orbitals. Indicate if this overlap would result in a sigma or pi bond. (Assume the internuclear axis is the z -axis).

- a) s and d_{z^2} orbital
- b) p_x and p_x
- c) p_z and s